



1500-RPK

**Raypak B6000 Metasys™ N2
System Protocol Interface**

Raypak Burner Controller

User Manual

March 15, 2005



Please Read This Notice

Successful application of this module requires a reasonable working knowledge of the Raypak B6000 Metasys™ N2 System Protocol Interface Raypak Burner Controller hardware and the application in which the combination is to be used. For this reason, it is important that those responsible for implementation satisfy themselves that the combination will meet the needs of the application without exposing personnel or equipment to unsafe or inappropriate working conditions.

This manual is provided to assist the user. Every attempt has been made to assure that the information provided is accurate and a true reflection of the product's installation requirements. In order to assure a complete understanding of the operation of the product, the user should read all applicable documentation on the operation of the hardware.

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IMPORTANT: The 1500 card will allow remote access to commands in the B6000 Controller. The User is responsible for assuring that any applicable regulations concerning the remote operation of equipment are adhered to.

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1 Product Specifications

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The ProSoft Technology, Inc. 1500-RPK card is a hardware product designed to be a communications front end for the Raypak B6000 Burner Controller and Johnson Controls N2 compatible masters.

The product includes the following functionality:

1.1 Metasys N2 Slave Interface

- Binary Input, Binary Output, Analog Input and Analog Output data type commands supported for primary control/monitoring of the B6000 operating parameters
- Supported Command/Subcommands:
 - 0/4 : Poll Message No Acknowledge
 - 0/5 : Poll Message with Acknowledge
 - 0/9 : Status Update
 - 1/1 : Read Analog Input Attributes
 - 1/2 : Read Binary Input Attributes
 - 1/3 : Read Analog Output Attributes
 - 1/4 : Read Binary Output Attributes
 - 2/1 : Write Analog Input Attributes
 - 2/2 : Write Binary Input Attributes
 - 2/3 : Write Analog Output Attributes
 - 2/4 : Write Binary Output Attributes
 - 7/2/3: Override Analog Output
 - 7/2/4: Override Binary Output

F : Identify Device Type

- The following commands are recognized, and acknowledged, but do not have impact on the operation of the 1500-N2, and do not return any data:

0/0 : Time Update

0/8 : Warm Start

All other commands return a Bad Command Error Code

- Warning and Alarming functions performed on Analog Input and Binary Input data types
- Change Of State Response buffering

1.2 Raypak B6000 Interface

- RS-485 electrical interface (as well as RS-232 and RS-422)
- Emulates Raypak Modem address and functionality

1.3 General Specifications

- Configuration via dip switches
Slave Address, Baud and Parity

1.4 Hardware Specifications

- 4"x5" form factor
- Two male 9-pin D shell connectors
- Slave communications port configurable for RS-232C or RS-422/485
- Communication status lights - Active and Fault for each port
- 9 to 30 VDC external power

2 Metasys Slave Port Functionality

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2.1 N2 Slave Communications

The ProSoft 1500 card supports the Johnson Controls Metasys™ N2 Protocol, as a slave, on port 1. This capability allows the module to communicate data from the Raypak B6000 Burner Controller to a Johnson Controls Metasys Master such as the Johnson Controls Companion™ or Metasys software.

The following discusses the functional capabilities of the card.

2.1.1 Command/Reply Cycle

Successful communications between a Slave and a Master will always consist of the following two transactions:

Signal	Description
Command:	Message from master giving instruction to slave.
Reply:	Response to command.

A slave station will respond to a master issued command in several ways.

Signal	Description
Data Message:	If the command was executed by the slave, the response message will include the data requested, or an acknowledgment that the command was executed.
Error Message:	If the command could not be executed by the slave, for whatever reason, an error response message is transmitted to the master. The error response message contains an error code indicating the cause of the error.
No Reply:	If the master does not detect a reply within its timeout period, the master should re-transmit the command, before a time out error is issued. If the Slave could not decode the message or an error occurred preventing the Slave from recognizing the message, no response will be issued.

2.1.2 N2 System Protocol Commands

The 1500 supports the commands and the data types necessary to enable control of the B6000 Controller from an N2 master. The data types and the commands, as well as the associated addressable points are discussed below.

Data Types

The N2 System protocol treats data as objects, with each data type having a different structure and purpose. The data types recognized by the 1500 card are as follows:

- Binary Input
- Binary Output
- Analog Input
- Analog Output

Reading Attributes

The data objects contain attributes which describe several a data point, and some of its functionality. The contents of these attributes, including object configuration, status, current value, and alarm/warning limits, can be accessed with the following commands:

- 1/1 Read Analog Input Attributes
- 1/2 Read Binary Input Attributes
- 1/3 Read Analog Output Attributes
- 1/4 Read Binary Output Attributes

Writing Attributes

The data object attributes can be configured by a master using the following commands:

- 2/1 Write Analog Input Attributes
- 2/2 Write Binary Input Attributes
- 2/3 Write Analog Output Attributes
- 2/4 Write Binary Output Attributes

Controlling the B6000 Controller

Access to the control functions is made available through the Override commands. The following commands allow the B6000 to be controlled:

- 7/2/3 Override Analog Output
- 7/2/4 Override Binary Output

Status Update

The host can issue a 'Status Update' command to the 1500. The response will contain device information ("1500-N2 Rev 1.0A") as well as current status information.

0/9 Status Update

Identify Device

When a master host first powers up, the 'Identify Device' command is issued to all of the slaves. In the case of the 1500 card, the Device Code 10 Hex is returned to the host. When the 1500 first powers up, it will return an error code 0 in response to all commands from the host, indicating to the host that a power up condition has occurred. The host will respond with the "Identify Device" command, telling the 1500 that the host has detected the power condition. The command code is:

F Identify Device

2.1.3 Command Error Checking

When the Slave cannot execute a command, an error code is generated and returned to the Master. Error codes generated at the Slave will usually be indicative of an illegal function, an illegal address, or bad data.

2.1.4 Data Integrity

As in all good protocols, there must exist a level of data integrity checking to verify, with some degree of assurance, the quality of the transmitted data. The N2 System protocol supports a summation/modulus type of error checking on the address and data content of the communication packet.

2.2 N2 Point Layout

A relationship between the N2 Point Address and the B6000 parameters has been set up to ease control and monitoring of the unit. The relationship, by data object type, is shown in detail in **Appendix A**.

3 Hardware Setup

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3.1 1500 Card Setup

3.1.1 Connecting Power to the 1500 Card

The 1500 Card requires an external source of DC voltage. The DC source voltage should be between 9V and 30V. The power is connected to TB1, located near the two 9 pin serial port connections.

The connection to TB1 is as follows:

TB1-1 9-30 VDC

TB1-2 Common

3.1.2 Dip Switch Configuration

The 1500 card is configured primarily through two sets of dip switches. These switches are read initially on power up only. The function of the dip switches is as follows (a value of one (1) is registered when the a switch is in the ON position):

SW 1 : Metasys Port Configuration

Switch	Function	Position
1	Baud Rate - 1 For Metasys N2 Systems:	1 = On
2	Baud Rate - 2	2 = Off
3	Baud Rate - 4	3 = On
	Configures N2 port for 9600 baud	
4	Parity - 1 For Metasys N2 Systems:	4 = Off
5	Parity - 2	5 = Off
	Configures N2 port for No Parity	
6	Not Used	
7	Not Used	
8	Not Used	

SW 2 : Metasys N2 Slave Address

Switch	Function	Position
1	Address Bit 0 Value = 1	Example:
2	Address Bit 1 Value = 2	Address 12
3	Address Bit 2 Value = 4	Bits 8 7 6 5 4 3 2 1
4	Address Bit 3 Value = 8	0 0 0 0 1 1 0 0
5	Address Bit 4 Value = 16	
6	Address Bit 5 Value = 32	
7	Address Bit 6 Value = 64	
8	Address Bit 7 Value = 128	

The parameters are defined as follows:

Metasys N2 Slave Address:

Each of the separate drops off of a Johnson Controls Metasys host must have a different slave address. The slave address is selected by encoding the slave address in a binary form using the dip switches.

3.1.3 1500 Jumper Configurations

The 1500 card has five sets of jumpers on the board. Generally, the default jumper positions will be adequate for most applications, with JP4 and JP5 being the only jumpers that should ever need to be reviewed. For completeness, we provide the following discussion on all of the jumper locations:

JP	Discussion
1	Hardware Reset (Not used)
2	Raypak Port Power (P2)
	1-2 Non-Isolated (Default)
	2-3 Isolated (Should not be used)
3	Raypak Port Ground (P2)
	1-2 Non-isolated (Default)
	2-3 Isolated (Should not be used)
4	Metasys Port (P1) Termination Resistor
	1-2 Connect 120 Ohms across Rec lines
	2-3 Disconnect 120 Ohms
5	Metasys Port (P1) RS-232 or RS-422/485 Select
	1-2 RS-232 Select (Should not be used)
	2-3 RS-422/485 Select (Default)

3.2 B6000 Communications

The B6000 communications interface has been hard coded to operate at the following default conditions:

Baud	9600
Parity	Odd
Stop Bits	1

The 1500 card emulates the modem card that is regularly connected to the B6000 Controller. This is important as when the 1500 card is connected to the B6000, the modem card **cannot** be connected simultaneously.

Default Baud Rates and Parity for all supported devices are different. Be sure to verify unit configurations.

4 N2 System Protocol Support

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- Control Commands 16
- Device Identifier Code 16

The ProSoft Technology 1500 card supports several data read and write commands for the N2 System protocol. The decision on which command to use is made depending on the type of data being addressed, and the level of protocol support in the master equipment. The following sections detail the different commands supported by the module.

4.1 Attribute Commands

The 1500 card supports the reading and writing to the data object attributes. Although read/write support is available for all attributes (i.e., the card will accept, store, and respond with values downloaded from a master), the 1500 does not use all aspects of the attribute functions. The following subsections discuss each data type, and in particular any functional aspects not supported by the 1500.

4.1.1 Analog Input

The Analog Input data object is by far the most complicated of the objects. All aspects of warning and alarm logic are supported by the 1500 (i.e., the 1500 uses the low and high alarm/warning limits to detect and trigger the object's alarm bits).

Not supported however are the linear ranging parameters, the filter weight, and the offset. The presumption is made that all analog input values gathered from the B6000 will come in scaled. No scaling parameters are required from the master to support any of the analog input values.

4.1.2 Binary Input

(02): Read Input Status

The Binary Input data object supports the normal state and alarm logic. The debounce and accumulator attributes are not supported.

4.1.3 *Analog Output*

The Analog Output data object is used by the 1500 as a simple conduit for setpoints in the B6000. No support is provided for scaling the output value, or for verifying the saturation level of the output value. The value written from the master is communicated to the Controller.

4.1.4 *Binary Output*

The Binary Output data object is implemented to respond directly to the commands received from the master. When the master sends an output command, either a bit set or reset, the command is decoded and communicated to the Controller.

4.2 Control Commands

The 1500 card accepts control commands from a master upon receipt of the following commands:

- Override Analog Output (Command 7/2/3)
- Override Binary Output (Command 7/2/4)

4.3 Device Identifier Code

When the 1500 receives an Identify Yourself command, the code 10 Hex is sent to the master. The 10 Hex is the device ID used by non-Johnson Controls hardware.

5 Diagnostics

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Several hardware diagnostics capabilities have been implemented using the LED indicator lights on the front of the 1500 card. The possible conditions as indicated by the lights are:

5.1 LED Indicators

Several hardware diagnostics capabilities have been implemented using the LED indicator lights on the front of the module. The possible conditions as indicated by the lights are:

NAME	LED	Color	Status	Indication
N2 (P1) ACTIVE	D1	Green	Blinking	The 1500 is receiving a valid response from the Metasys Host
			Off	The 1500 is not detecting a valid command. If the master is transmitting, be sure all dip switches are set correctly.
Raypak (P2) ACTIVE	D2	Green	Blinking	The 1500 is processing a B6000 command
			OFF	Check cable connections
N2 (P1) COMM ERR	D3	Red	ON	The Metasys port has detected a communications error condition
			OFF	No error conditions at this time.
Raypak (P2) FAULT	D4	Red	ON	The 1500 card has detected a communications error condition.
			OFF	No error conditions at this time.

Should the configuration dip switches select an invalid address or an invalid baud rate, the LED indicators will alternate in an on/off fashion on 1/2 second intervals until correct values are selected.

APPENDIX A - Metasys Point Mapping

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Raypak Metasys Register Assignments

Analog Output	Parm Offset	Description	Msg #1
AO1	28	Setpoint Day Setup (Desired water temp @ 70F)	1
AO2	29	Niteset Night Setpoint (Desired water temp @ 70F)	2
AO3	30	Ratio Out 1-200 = 0.1 – 20.0 in 0.1 increments	3
AO4	31	Throttling Delta T of all boilers in system Rise	4
AO5	32	Modulating Step (%)	5
AO6	33	Wait State Time (Sec)	6
AO7	34	Outdoor Cut off temperature	7
AO8	35	Contro Band (degrees F tolerance from TAR)	8
AO9	36	Lead Boiler Number (1 to Number of Boilers online)	9
AO10	37	Number of Boilers on line	10
AO11	38	TP – Boiler Pump Delays (Min) Boiler #1	11
AO12	39	TP – Boiler Pump Delays (Min) Boiler #2	12
AO13	40	TP – Boiler Pump Delays (Min) Boiler #3	13
AO14	41	TP – Boiler Pump Delays (Min) Boiler #4	14
AO15	42	TP – Boiler Pump Delays (Min) Boiler #5	15
AO16	43	TP – Boiler Pump Delays (Min) Boiler #6	16
AO17	44	TP – Boiler Pump Delays (Min) Boiler #7	17
AO18	45	TP – Boiler Pump Delays (Min) Boiler #8	18
AO19	46	TS – Boiler Start Times (Sec) Boiler #1	19
AO20	47	TS – Boiler Start Times (Sec) Boiler #2	20
AO21	48	TS – Boiler Start Times (Sec) Boiler #3	21
AO22	49	TS – Boiler Start Times (Sec) Boiler #4	22
AO23	50	TS – Boiler Start Times (Sec) Boiler #5	23
AO24	51	TS – Boiler Start Times (Sec) Boiler #6	24
AO25	52	TS – Boiler Start Times (Sec) Boiler #7	25
AO26	53	TS – Boiler Start Times (Sec) Boiler #8	26
AO27	54	Time – Hrs	27

Analog Output	Parm Offset	Description	
AO28	55	Time – Min	28
AO29	56	Time – DWK	29
AO30	57	Lead Change Hours	30
	58	Night Setback	Msg #2 1

Binary Output	Parm Offset	Description	
BI_1	0	Bit 0 = Night Setback present	
	59	Controller LED Status	2
BI_2	0	Bit 0 = Fault Status (1=system fault)	
BI_3	1	Bit 1 = Call Out Request (1 = Yes)	

Raypak Metasys Register Assignments

Analog Input	Parm Offset	Description	
AI_1	60	Outdoor Temp + 35	3
AI_2	61	Indoor Temp + 35	4
AI_3	62	Controller Target Temp	5
AI_4	63	Valve Positions (0-100%) - Boiler #1	6
AI_5	64	Valve Positions (0-100%) - Boiler #2	7
AI_6	65	Valve Positions (0-100%) - Boiler #3	8
AI_7	66	Valve Positions (0-100%) - Boiler #4	9
AI_8	67	Valve Positions (0-100%) - Boiler #5	10
AI_9	68	Valve Positions (0-100%) - Boiler #6	11
AI_10	69	Valve Positions (0-100%) - Boiler #7	12
AI_11	70	Valve Positions (0-100%) - Boiler #8	13
BI_5_14	71	Boiler Status (0-10) - Boiler #1	0x3d 1
BI_15_24	72	Boiler Status (0-10) - Boiler #2	2
BI_25_34	73	Boiler Status (0-10) - Boiler #3	3
BI_35_44	74	Boiler Status (0-10) - Boiler #4	4
BI_45_54	75	Boiler Status (0-10) - Boiler #5	5
BI_55_64	76	Boiler Status (0-10) - Boiler #6	6
BI_65_74	77	Boiler Status (0-10) - Boiler #7	7
BI_75_84	78	Boiler Status (0-10) - Boiler #8	8

Analog Input	Parm Offset	Description	
AI_12	79	Setpoint	Day Setup (Desired water temp) 9
AI_13	80	Niteset	Night Setpoint (Desired water temp) 10
AI_14	81	Ratio Out	1-200 = 0.1 - 20.0 in 0.1 incr. 11
AI_15	82	Throttling	Delta T of all boilers in system 12
AI_16	83	Modulating Step (%)	13
AI_17	84	Wait State Time (Sec)	14
AI_18	85	Outdoor Cut off temperature	15
AI_19	86	Contro Band (degrees F tolerance from TAR)	16
AI_20	87	Lead Boiler Number (1 to Number of Boilers online)	17
AI_21	88	Number of Boilers on line	18
AI_22	89	TP - Boiler Pump Delays (Min) Boiler #1	0x4f 1
AI_23	90	TP - Boiler Pump Delays (Min) Boiler #2	2
AI_24	91	TP - Boiler Pump Delays (Min) Boiler #3	3
AI_25	92	TP - Boiler Pump Delays (Min) Boiler #4	4
AI_26	93	TP - Boiler Pump Delays (Min) Boiler #5	5
AI_27	94	TP - Boiler Pump Delays (Min) Boiler #6	6
AI_28	95	TP - Boiler Pump Delays (Min) Boiler #7	7
AI_29	96	TP - Boiler Pump Delays (Min) Boiler #8	8
AI_30	97	TS - Boiler Start Times (Sec) Boiler #1	9
AI_31	98	TS - Boiler Start Times (Sec) Boiler #2	10
AI_32	99	TS - Boiler Start Times (Sec) Boiler #3	11
AI_33	100	TS - Boiler Start Times (Sec) Boiler #4	12
AI_34	101	TS - Boiler Start Times (Sec) Boiler #5	13
AI_35	102	TS - Boiler Start Times (Sec) Boiler #6	14
AI_36	103	TS - Boiler Start Times (Sec) Boiler #7	15
AI_37	104	TS - Boiler Start Times (Sec) Boiler #8	16
AI_38	105	Time - Hrs	
AI_39	106	Time - Min	
AI_40	107	Time - DWK	
AI_41	108	Lead Change	
AI_42	109	Hrs Remaining	
BI_4	110	Bit 0 = Setback on (1)	
AI_43	111/112	Boiler Valve Up Times (Sec)	#1
AI_44	113/114	Boiler Valve Up Times (Sec)	#2
AI_45	115/116	Boiler Valve Up Times (Sec)	#3
AI_46	117/118	Boiler Valve Up Times (Sec)	#4
AI_47	119/120	Boiler Valve Up Times (Sec)	#5
AI_48	121/122	Boiler Valve Up Times (Sec)	#6

Analog Input	Parm Offset	Description		
AI_49	123/124	Boiler Valve Up Times (Sec)	#7	
AI_50	125/126	Boiler Valve Up Times (Sec)	#8	
AI_51	127/128	Boiler Valve Down Times (Sec)	#1	
AI_52	129/130	Boiler Valve Down Times (Sec)	#2	
AI_53	131/132	Boiler Valve Down Times (Sec)	#3	
AI_54	133/134	Boiler Valve Down Times (Sec)	#4	
AI_55	135/136	Boiler Valve Down Times (Sec)	#5	
AI_56	137/138	Boiler Valve Down Times (Sec)	#6	
AI_57	139/140	Boiler Valve Down Times (Sec)	#7	
AI_58	141/142	Boiler Valve Down Times (Sec)	#8	
	143			
	144			
	145			
	146			
	147			
	148			
	149			
AI_59	150	OC Dead band: Off T>)C, ON T<=OC-OCDB	4621h	extra read registers
AI_60	151	Wait1 : Wait State Time	4605h	
AI_61	152	KPN : Porp Constant Numerator (0-255)	460bh	
AI_62	152	KPD: Porp Constant Denominator (0-255)	460ch	
AI_63	153	KDN : Diff Constant Numerator (0-255)	460fh	
AI_64	154	KDD: Diff Constant Denominator (0-255)	4610h	
	155	Spare		
	156	Spare		
	157	Spare		
	158	Spare		
	159	Spare		
AO31	160	OC Dead band: Off T>)C, ON T<=OC-OCDB	4621h	extra write registers
AO32	161	Wait1 : Wait State Time	4605h	
AO33	162	KPN : Porp Constant Numerator (0-255)	460bh	
AO34	163	KPD: Porp Constant Denominator (0-255)	460ch	
AO35	164	KDN : Diff Constant Numerator (0-255)	460fh	

Analog Input	Parm Offset	Description	
AO36	165	KDD: Diff Constant Denominator (0-255)	4610h

Binary Input	Parm Offset	Description	
BO_1	166	Initialize B6000 by writing STAR 80h 0dh to unit	STAR
BO_2	167	Setback on/off control (0 = Off, 1 = On) - Write word value to B6000	4025h
	168	Spare	
	169	Spare	

APPENDIX B - Communication Cable Connection Diagrams

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PORT 1 - N2 System Protocol Slave Communication Port

RS-485 CABLE CONFIGURATION

1500 Card	NCM		
1	Tx_A	-----	N2 +
4	Rx_A	----	
6	Tx_B	-----	N2 -
9	Rx_B	----	
7	RTS	----	
8	CTS	----	
5	GND	-----	N2 Ref

PORT 2 - Raypak B6000 Controller Communication Port

RS-485 CABLE CONFIGURATION

1500 Card		B6000	
2	Rx_B	-----	(-) Blue w/ white stripe
9	Tx_B	---+	
4	Tx_A	-----	(+) White w/ blue strip
6	Rx_A	---+	
5	COM	-----	Orange w/ white stripe

Support, Service & Warranty

ProSoft Technology, Inc. survives on its ability to provide meaningful support to its customers. Should any questions or problems arise, please feel free to contact us at:

Internet	Web Site: http://www.prosoft-technology.com/support E-mail address: support@prosoft-technology.com
Phone	(661) 716-5100 (661) 716-5101 (Fax)
Postal Mail	ProSoft Technology, Inc. 1675 Chester Avenue, Second Floor Bakersfield, CA 93301

Before calling for support, please prepare yourself for the call. In order to provide the best and quickest support possible, we will most likely ask for the following information (you may wish to fax it to us prior to calling):

- Product Serial and Version Number
- 1500 Configuration Information
- Dip Switches
- Jumpers
- Communication cabling

An after-hours answering system (on the Bakersfield number) allows pager access to one of our qualified technical and/or application support engineers at any time to answer the questions that are important to you.

Module Service and Repair

The 1500-RPK device is an electronic product, designed and manufactured to function under somewhat adverse conditions. As with any product, through age, misapplication, or any one of many possible problems the device may require repair.

When purchased from ProSoft Technology, Inc., the device has a 1 year parts and labor warranty according to the limits specified in the warranty. Replacement and/or returns should be directed to the distributor from whom the product was purchased. If you need to return the device for repair, obtain an RMA (Returned Material Authorization) number from ProSoft Technology, Inc.. Please call the factory for this number, and print the number prominently on the outside of the shipping carton used to return the device.

General Warranty Policy

ProSoft Technology, Inc. (Hereinafter referred to as ProSoft) warrants that the Product shall conform to and perform in accordance with published technical specifications and the accompanying written materials, and shall be free of defects in materials and workmanship, for the period of time herein indicated, such warranty period commencing upon receipt of the Product.

This warranty is limited to the repair and/or replacement, at ProSoft's election, of defective or non-conforming Product, and ProSoft shall not be responsible for the failure of the Product to perform specified functions, or any other non-conformance caused by or attributable to: (a) any misapplication or misuse of the Product; (b) failure of Customer to adhere to any of ProSoft's specifications or instructions; (c) neglect of, abuse of, or accident to, the Product; or (d) any associated or complementary equipment or software not furnished by ProSoft.

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Hardware Product Warranty Details

Warranty Period: ProSoft warranties hardware Product for a period of 1 year.

Warranty Procedure: Upon return of the hardware Product ProSoft will, at its option, repair or replace Product at no additional charge, freight prepaid, except as set forth below. Repair parts and replacement Product will be furnished on an exchange basis and will be either reconditioned or new. All replaced Product and parts become the property of ProSoft. If ProSoft determines that the Product is not under warranty, it will, at the Customer's option, repair the Product using current ProSoft standard rates for parts and labor, and return the Product freight collect.

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